

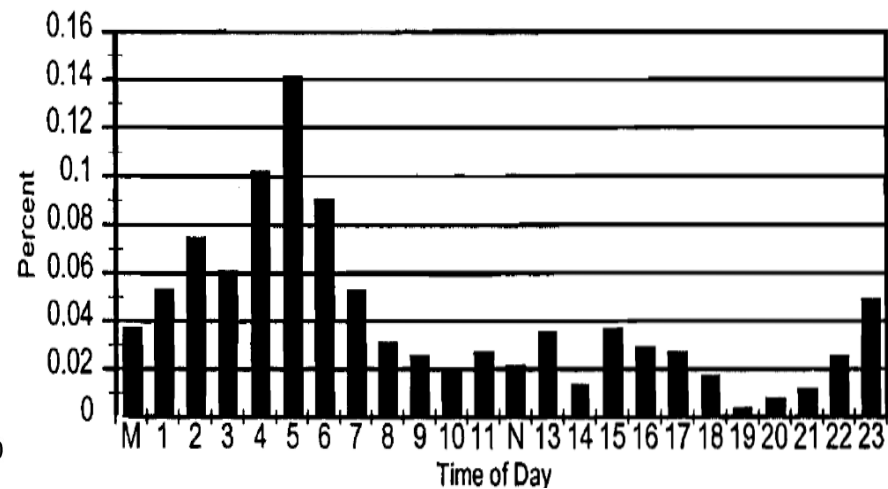
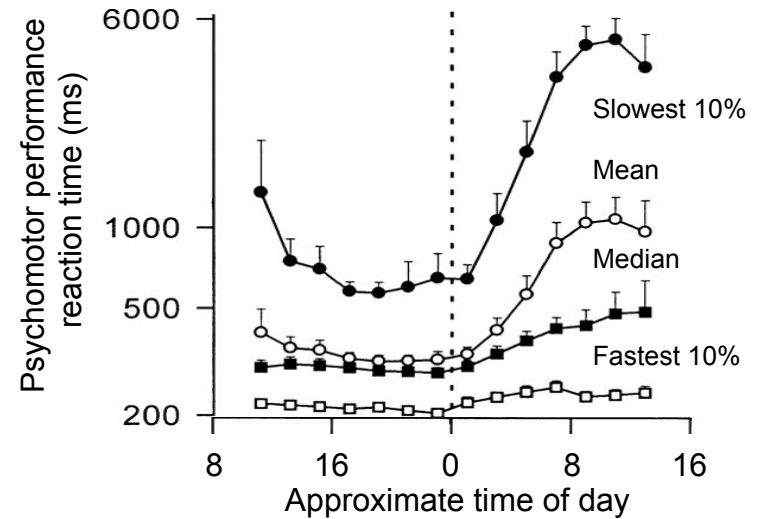
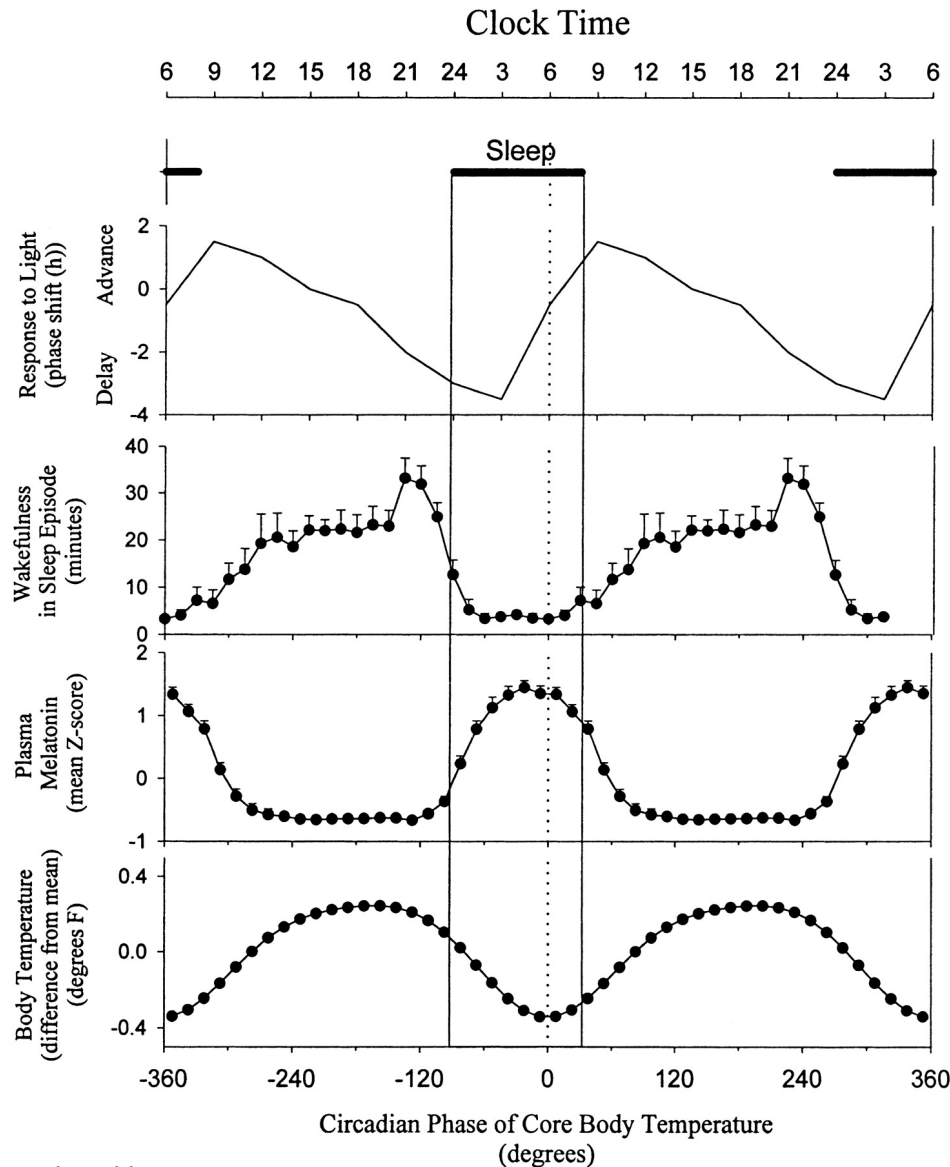


Variations in Sleep and Performance by Duty Start Time in Short Haul Operations

Erin Flynn-Evans, PhD MPH

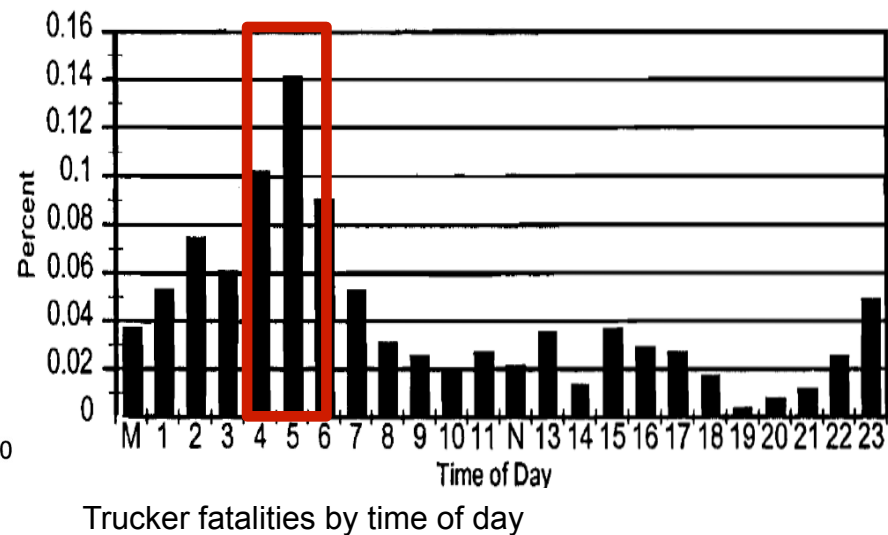
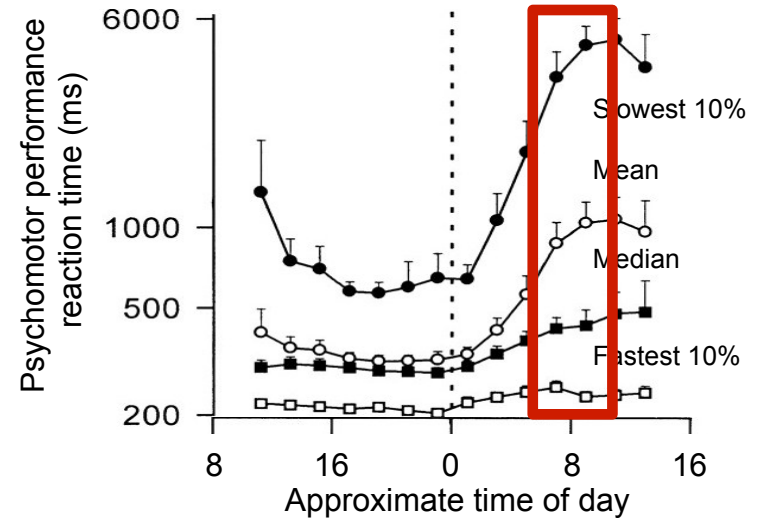
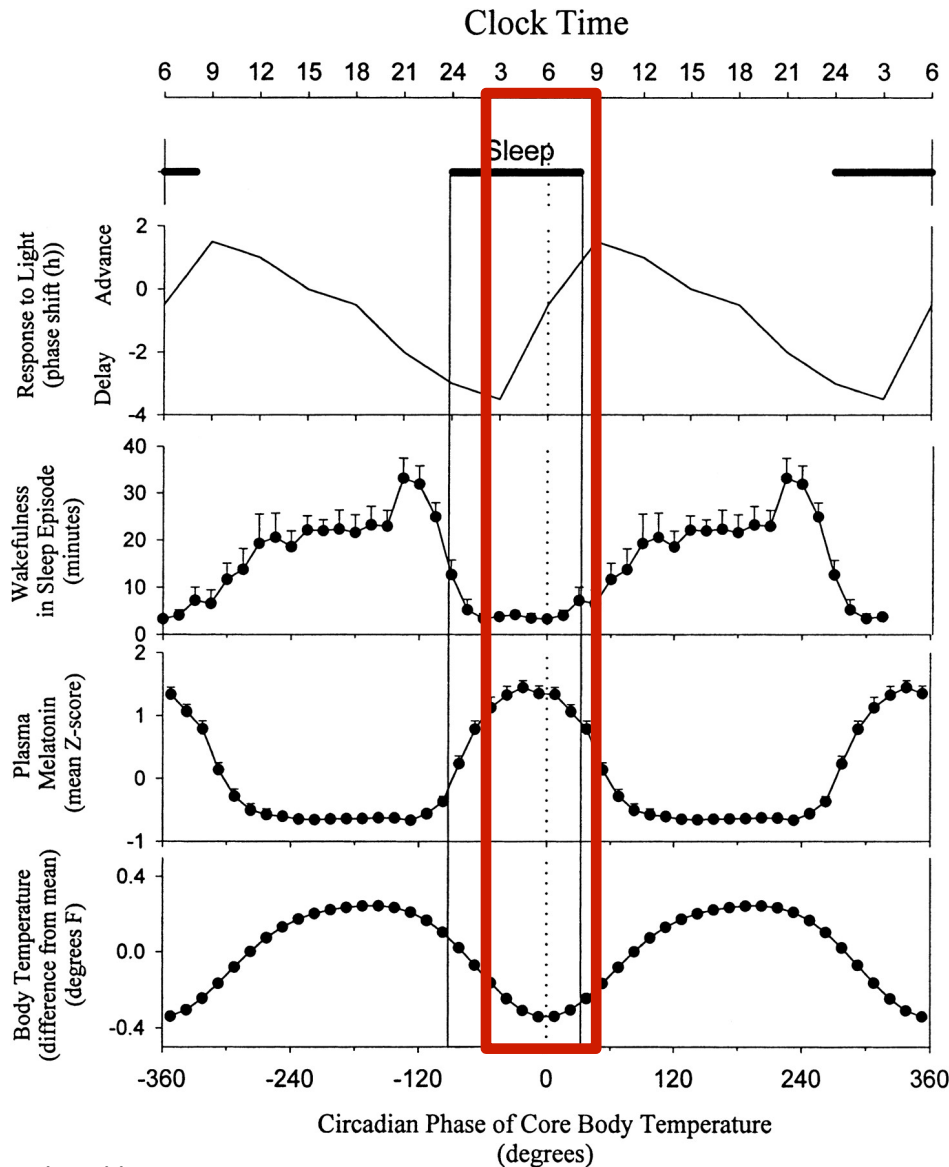
Fatigue Countermeasures Laboratory
NASA Ames Research Center

Short Haul Pilots can Experience Circadian Misalignment

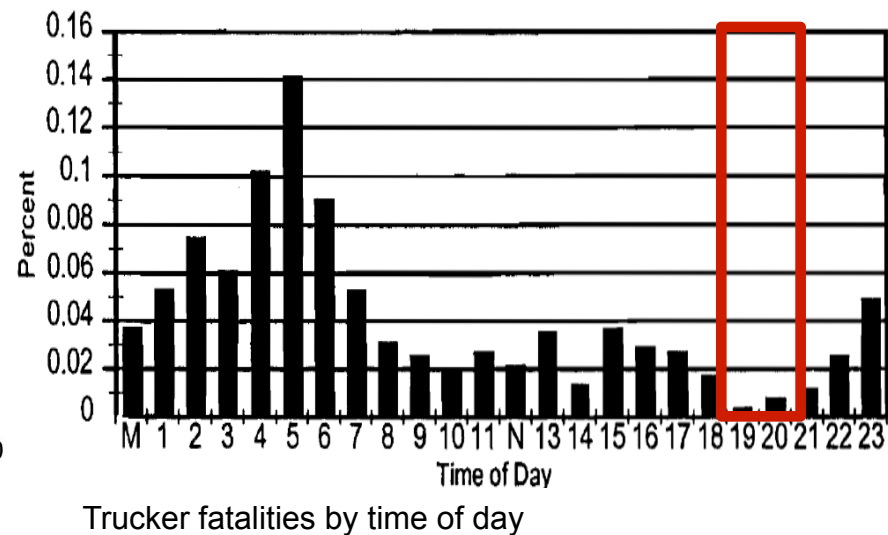
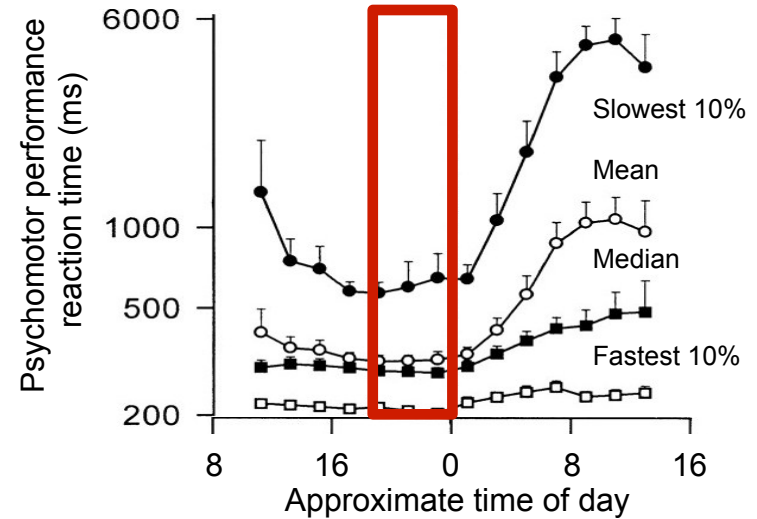
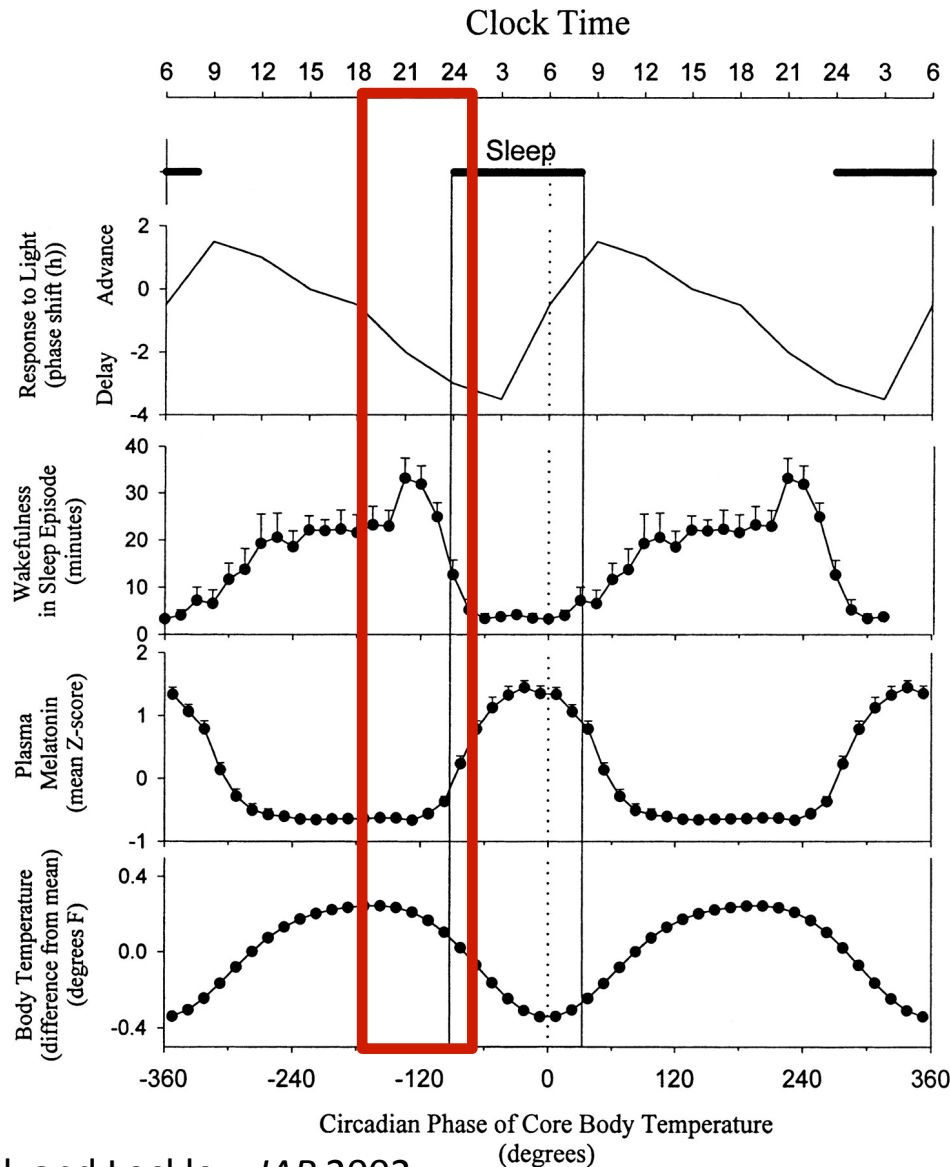


Trucker fatalities by time of day

Circadian Nadir = Poorest Performance and Highest Sleep Drive



Circadian Wake Maintenance Zone = Lowest Sleep Drive

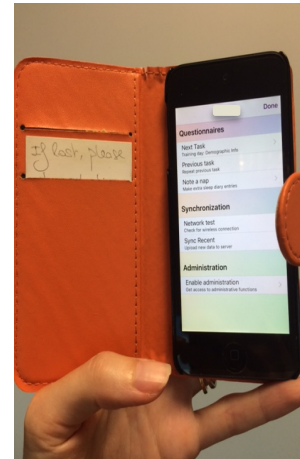


Short Haul Aviation Study

- Systematic evaluation of schedule types
 - Baseline, early, evening, night schedules
 - Assessment during duty days and days off

- Outcomes

- Hassle factors
- PVT on iPod
- Actigraphy
- Sleep logs
- Sleepiness scales, countermeasure logs
- Urine collection for melatonin assessment



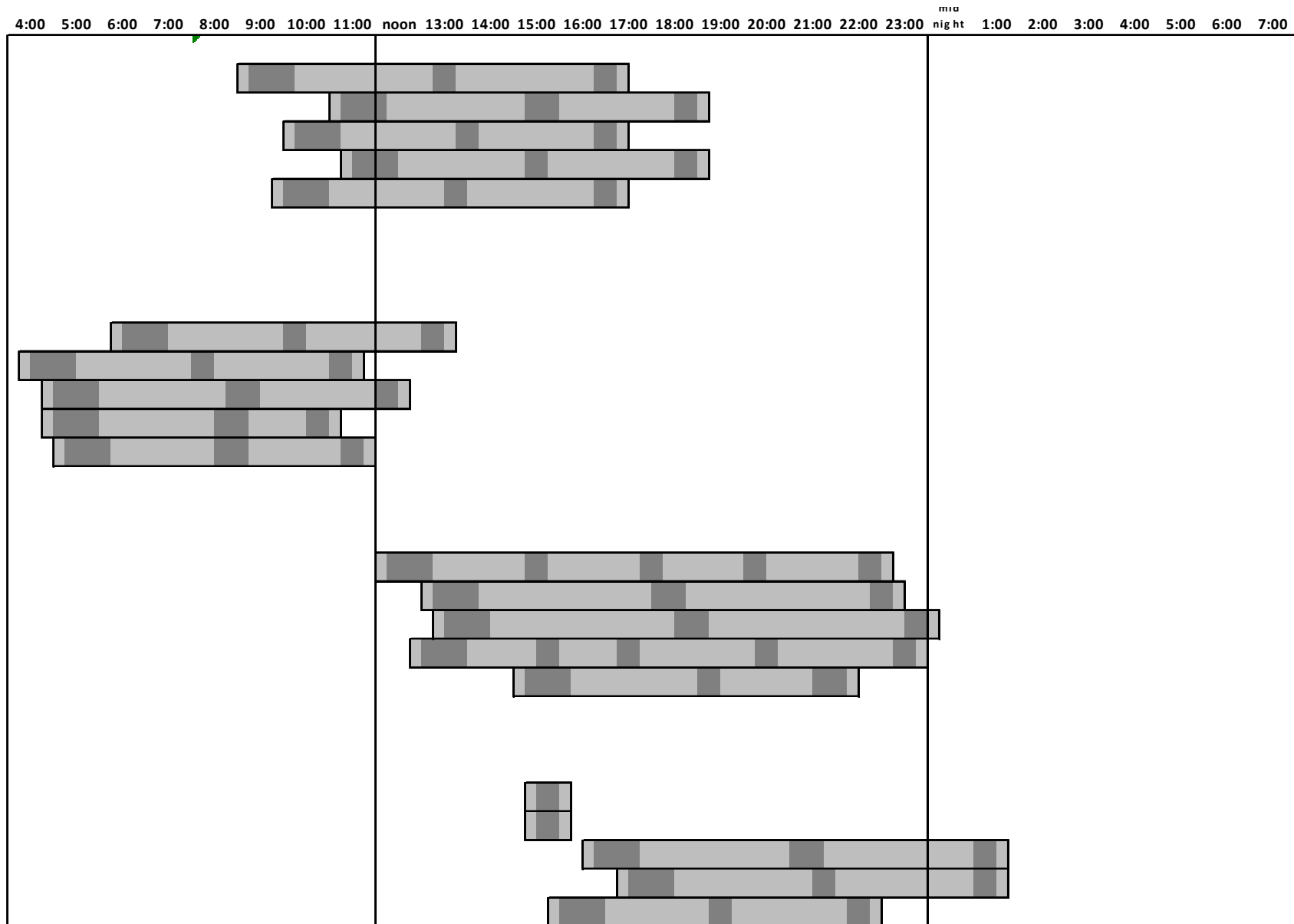
- Data Mining

- Operational outcomes
- Correlations with fatigue measures

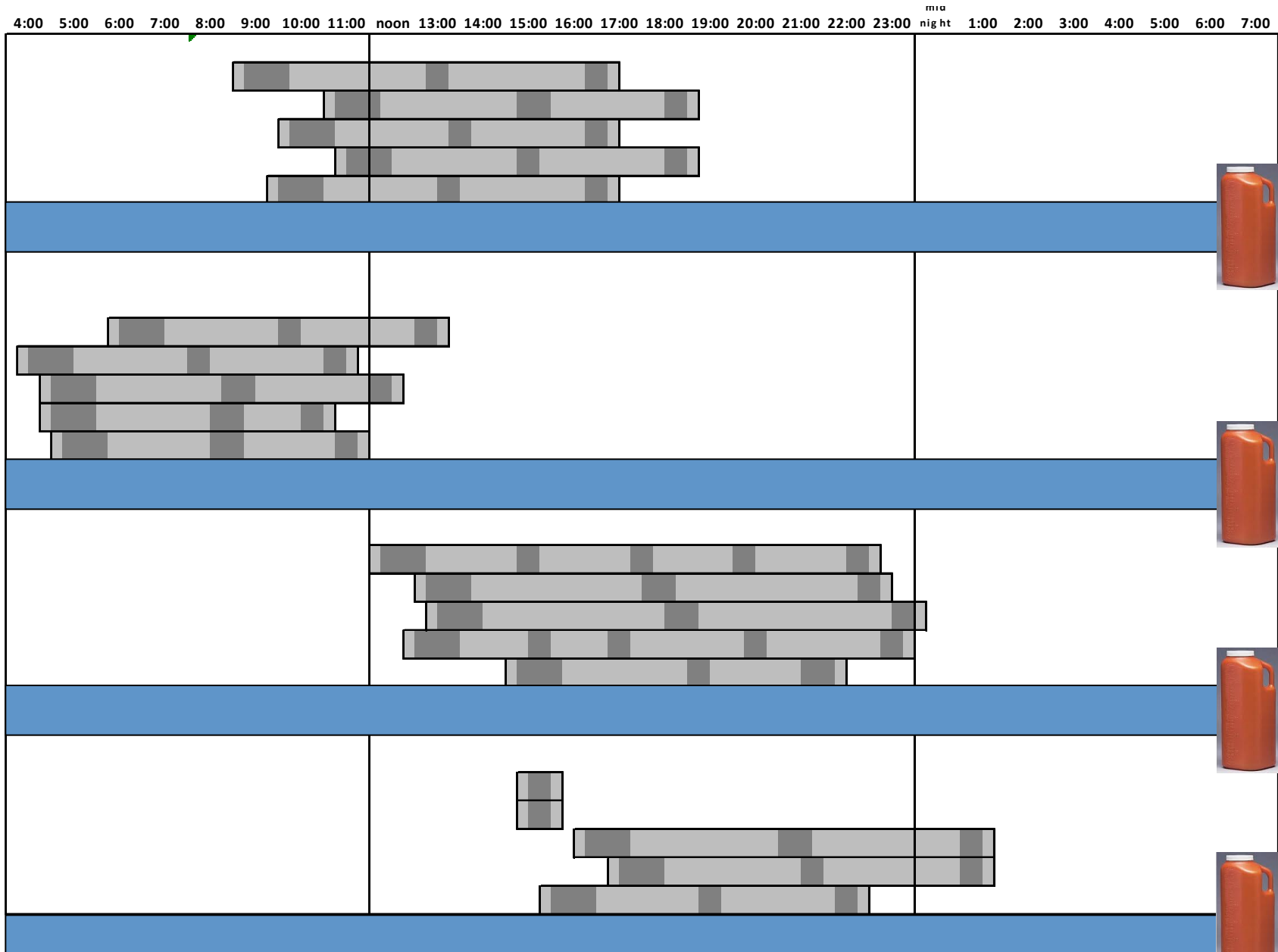
n = 44 study

n = 13 urine collection

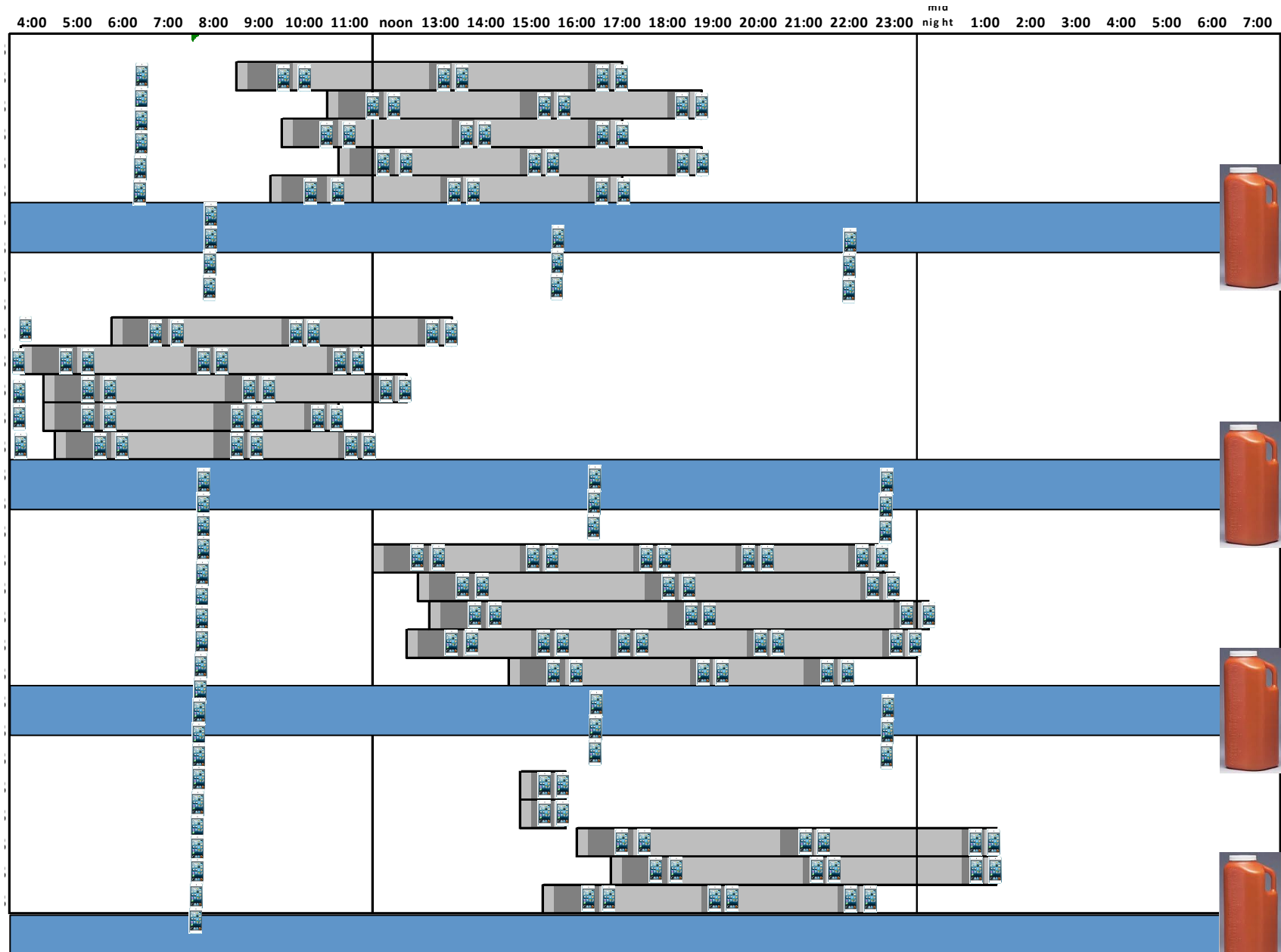
Study Protocol



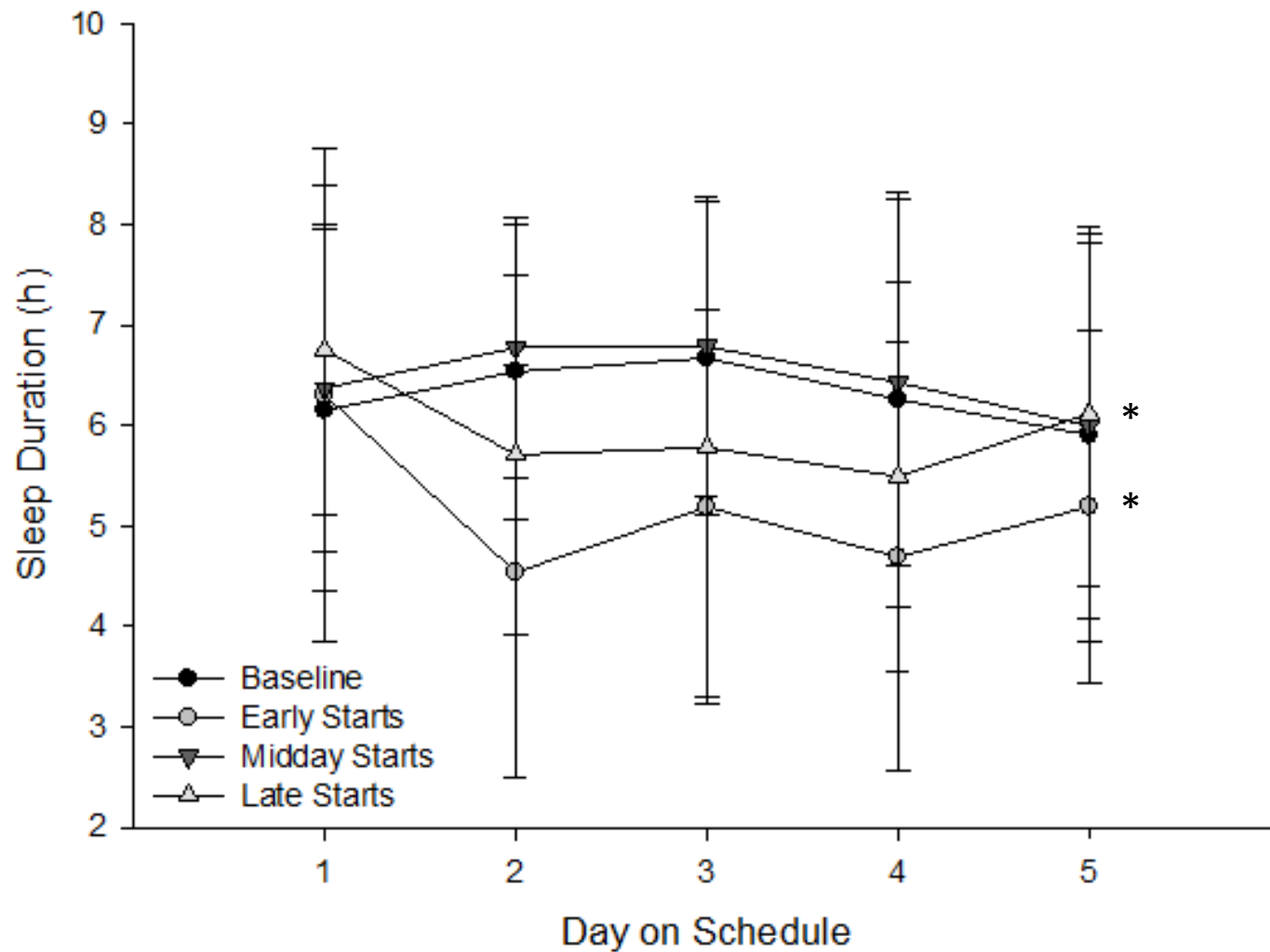
Study Protocol



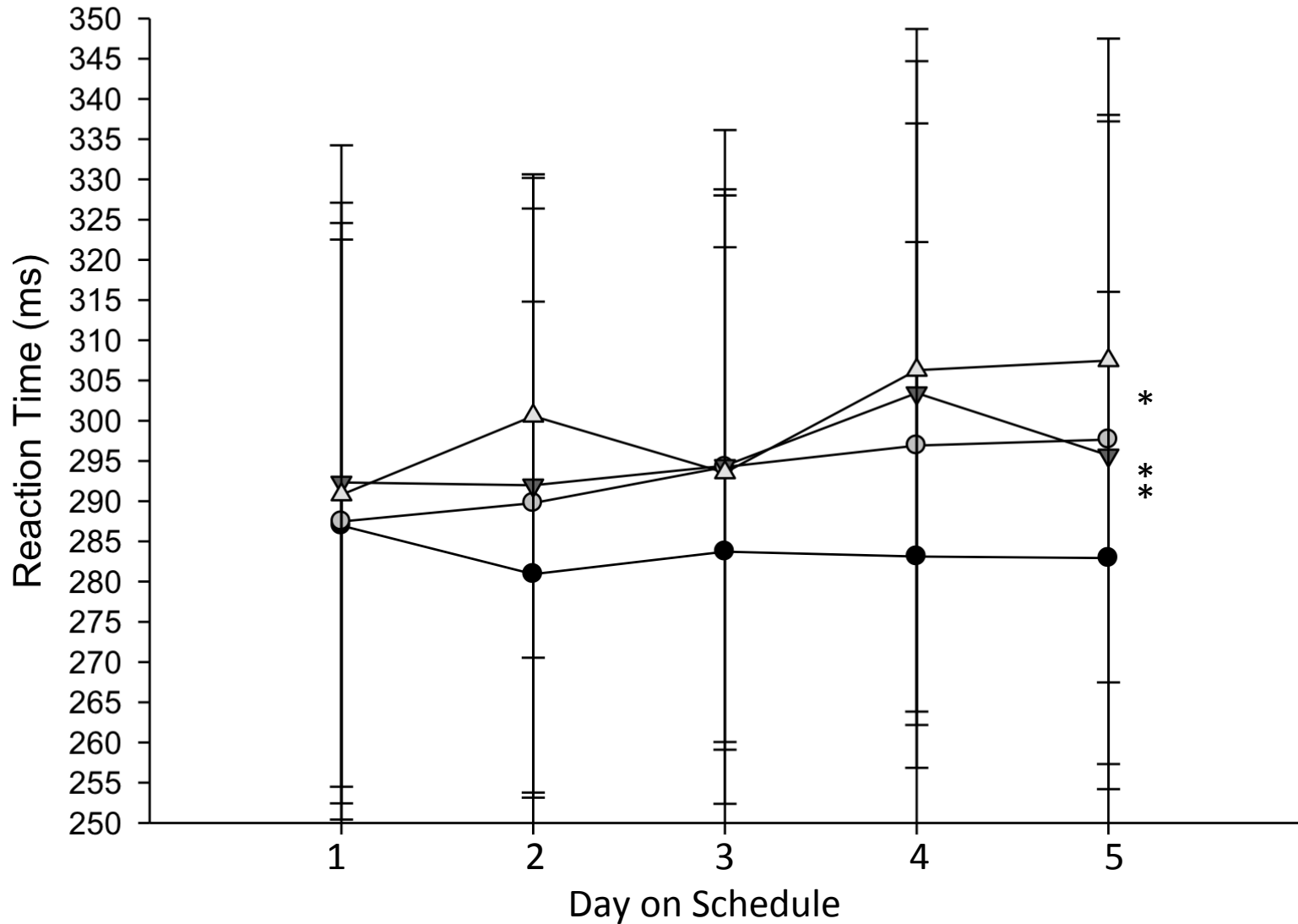
Study Protocol



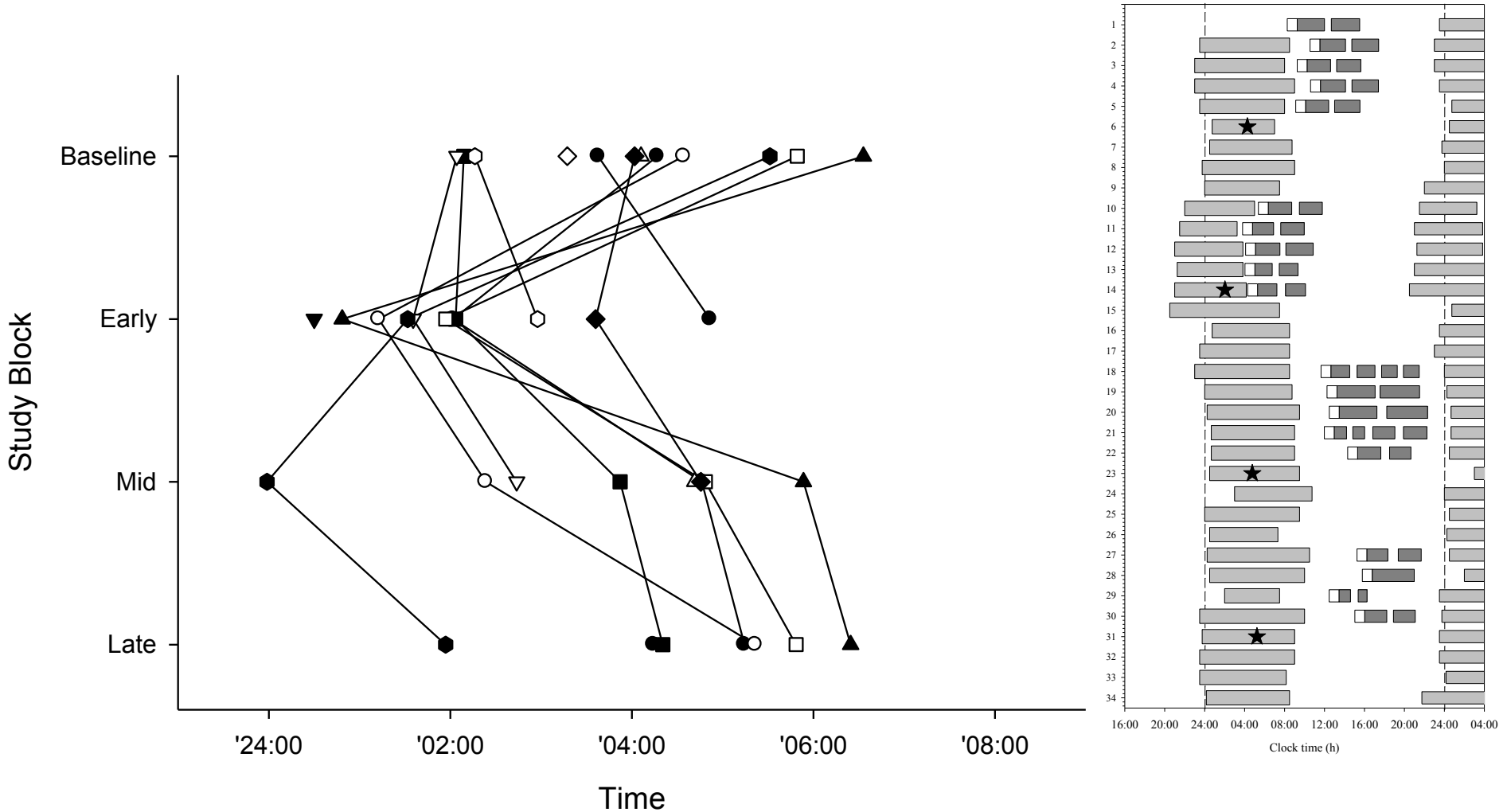
Sleep Outcomes



Performance Varied by Duty Start Time



Circadian Phase Shifts



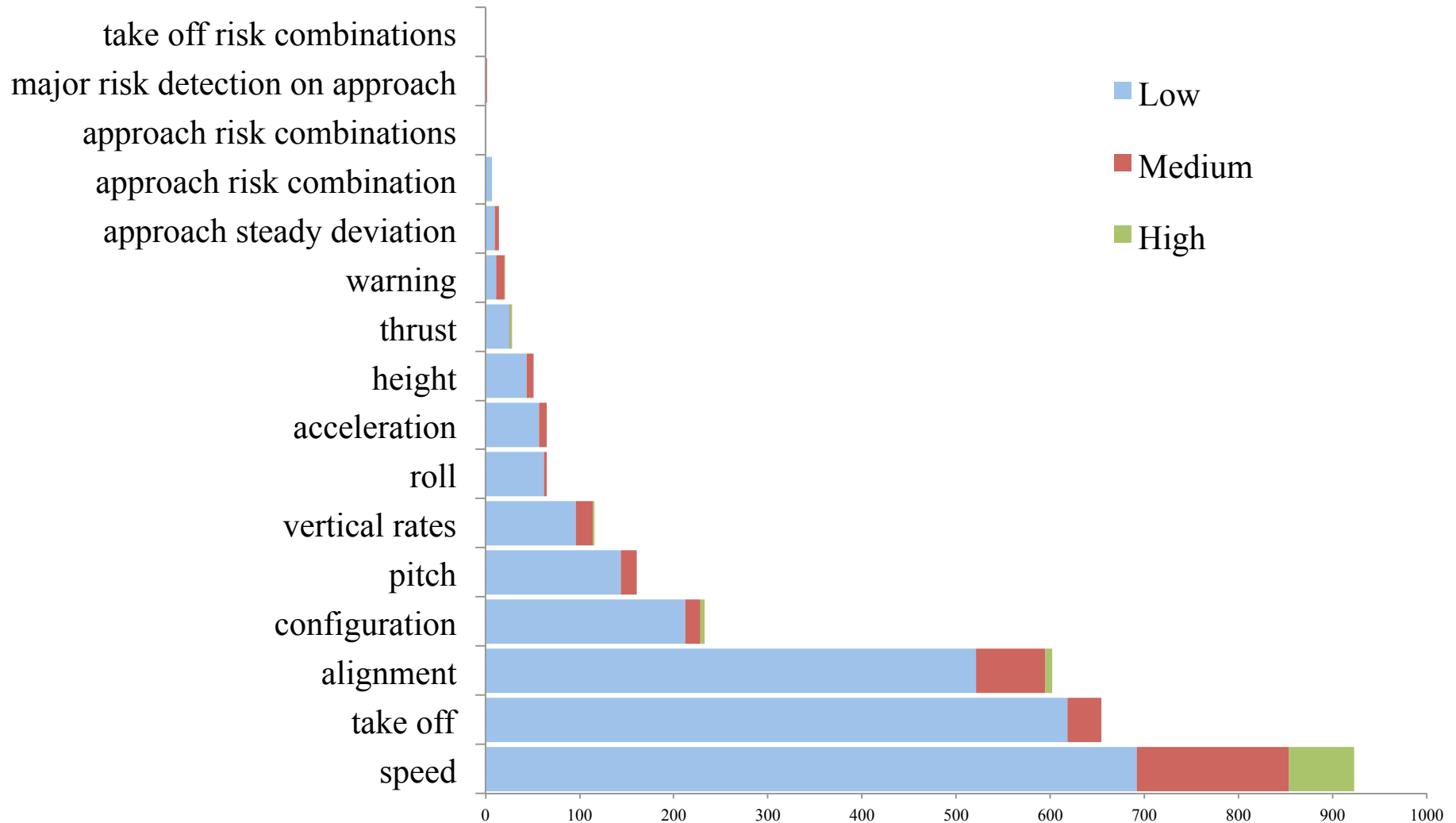
Aircraft Performance

Exceedance and Anomaly Detection

- n = 1644 flights
- Flights coincided with collection of human performance data

Severity Type	Min	Max	Sum	M	SD
Low	0	8	2499	2.19	1.64
Medium	0	4	358	.31	.60
High	0	2	87	.08	.29

Categories of Events



Human Performance v. Aircraft Performance Measures

	N (flights)	Mean PVT	Mean exceedances
Baseline	204	212.02(29.72)	1.91(1.91)
Early duty	207	222.31(34.32)*	2.73(2.04)**
Mid duty	254	221.62(33.59)*	2.77(1.84)**
Late duty	139	227.48(35.16)**	2.71(2.10)*

Exeedances by Type and Duty Schedule

		Severity Type			Overall
	n	Low	Medium	High	
Baseline	143	1.73(1.78)	.18(.47)	.08(.27)	1.99(1.99)
Early duty	196	2.31(1.79)**	.31(.61)*	.12(.9)	2.74(2.10)**
Midday duty	238	2.44(1.56)*	.30(.61)	.07(.29)	2.81(1.85)*
Late duty	138	2.27(1.65)	.44(.73)	.04(.24)	2.73(2.07)

Acknowledgements

NASA ARC Fatigue Countermeasures Laboratory

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